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Amendment of Part 2 of the Commission's Rules to Allocate the 455-456 MHz and 459-460 MHz bands to the Mobile-Satellite Service

ET Docket No. 97-214

COMMENTS OF ORBITAL COMMUNICATIONS CORPORATION

Counsel for Orbital Communications Corporation

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SUMMARY

Orbital Communications Corporation ("ORBCOMM") urges the Commission to adopt its proposed domestic allocation of the 455-456 MHz and 459-460 MHz bands to NVNG MSS or "Little LEO" service. Such an allocation will help the benefits of the enhanced communications made possible by Little LEO systems to be delivered to under- and unserved markets in the United States.

The record firmly establishes the need for additional spectrum for Little LEO services, and these two megahertz of spectrum provide the best near term relief for the expected congestion in the subscriber uplink band. Indeed, ORBCOMM is concerned that all three of the commercial non-spread spectrum systems will be unable to find a sufficient number of unoccupied channels in the less than 1.2 MHz of spectrum now available for their subscriber uplinks.

The record also establishes that the Little LEO systems should be able to share the spectrum with the current terrestrial users without causing harmful interference or constraining their operations. DCAAS scanning and other mitigation techniques (including interstitial channels and very brief transmissions) have worked successfully for the over two years that ORBCOMM has been operating its initial satellites. In addition, for many Little LEO applications, such as remote meter reading, operations can be programmed for the middle of the night when terrestrial operations are at a minimum. Finally, to the extent deemed necessary, the oil spill channel can be protected.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of

Amendment of Part 2 of the Commission's Rules to
Allocate the 455-456 MHz and 459-460 MHz bands
to the Mobile-Satellite Service

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) ET Docket No. 97-214
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COMMENTS OF ORBITAL COMMUNICATIONS CORPORATION

Orbital Communications Corporation ("ORBCOMM") hereby comments on the Commission's proposal to allocate approximately two megahertz of spectrum for use by the Non-Voice-Non-Geostationary Mobile Satellite Service ("NVNG MSS") on what amounts to a secondary basis.^{1/} ORBCOMM is very interested in this proceeding because of its role as a leader in the development of low-Earth orbit ("LEO") mobile satellite services and as the first commercial licensee and operator of a Little LEO satellite system.^{2/} As detailed below, ORBCOMM supports the Commission's proposal to allocate this modest amount of additional spectrum for subscriber uplinks for the Little LEO service.

^{1/} *Amendment of Part 2 of the Commission's Rules to Allocate the 455-456 MHz and 459-460 MHz bands to the Mobile-Satellite Service*, ET Docket No. 97-214, FCC 97-363, released October 14, 1997 (hereafter "Notice").

^{2/} The Little LEO satellite services are alternatively referred to as NVNG MSS.

ORBCOMM has been the progenitor of and active participant in previous Little LEO spectrum allocation proceedings at the Commission,^{3/} as well as an active participant in the World Radiocommunication Conferences ("WRCs") that addressed spectrum allocation issues for the Little LEO satellite systems. ORBCOMM assisted the United States government in its efforts to obtain the additional two megahertz of spectrum at WRC-95 that is at issue in this proceeding. Having succeeded in obtaining the regional allocation at WRC-95, ORBCOMM believes it is critical for the United States to allocate that spectrum domestically for the Non-Voice, Non-Geostationary Mobile Satellite Service.

I. THE PROPOSED ALLOCATION WOULD WELL SERVE
THE PUBLIC INTEREST

The Commission has already determined that the NVNG satellite services well serve the public interest by making available efficient communications capabilities to unserved and underserved markets.^{4/} ORBCOMM also believes that the record now amply demonstrates the need for additional spectrum for Little LEO services, a view tentatively shared by the Commission in the Notice.^{5/} Within the United States, the demand for Little LEO

3/ ORBCOMM filed the petition for rulemaking to allocate spectrum and develop service rules for low-Earth orbit satellite services below 1 GHz. Orbital Communications Corporation, RM No. 7334, Public Notice Report No. 1814, April 4, 1990. The Commission subsequently adopted the proposed allocation. Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum to the Fixed-Satellite Service and the Mobile-Satellite Service for Low-Earth Orbit Satellites, Report and Order, 8 FCC Rcd 1812 (1993).

4/ E.g., Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum to the Fixed-Satellite Service and the Mobile-Satellite Service for Low-Earth Orbit Satellites, Report and Order, 8 FCC Rcd at 1813.

5/ Notice at ¶'s 7-8.

spectrum, as reflected in the soon-to-be-completed second processing round, exceeds the supply. The various applicants have had to make compromises to their system designs in order to all be accommodated in the limited amount of spectrum available. In addition, a number of other countries have also begun the processes for licensing additional Little LEO systems, which are at varying stages of licensing and international coordination.^{6/}

An extensive record has also been developed in preparation for the recent Radiocommunications Conferences demonstrating that significant additional spectrum will be necessary to support the anticipated demand for Little LEO services.^{7/} Indeed, the United States made a sufficiently convincing demonstration at WRC-95 that it led to the allocation of the two megahertz at issue here. In addition, based on the record evidence of a need for additional spectrum for Little LEO satellite services, the United States attempted to obtain further allocations at WRC-97. Thus, ORBCOMM believes that the generalized need for more spectrum for the NVNG satellite service is now established beyond dispute.

ORBCOMM also contends that there is a pressing need for these particular two megahertz of spectrum to be used for subscriber uplinks.^{8/} Under the current sharing

^{6/} In addition to the multiple Little LEO systems licensed (or soon to be licensed) in the United States, some twelve countries have announced below 1 GHz satellite systems: Australia, Belgium, Brazil, France, Germany, India, Italy, Korea, Mexico, Russia, Tonga and Uganda.

^{7/} For example, the CPM for WRC-97 acknowledged a need for upwards of an additional 21 MHz of spectrum for Little LEO services -- 17 MHz on a shared basis for service links and 4 MHz on a shared basis for feeder links. 1997 CPM Report at § 4.1.1.14.

^{8/} It may also be possible to use some of this spectrum for feeder link gateways, because such Earth stations are expected to be very few in number and can be located in very remote locations. Any use of the spectrum for gateways would, of course, need to be coordinated with the terrestrial users on a site-specific basis.

proposal, subscriber uplinks for the non-spread spectrum systems are limited to somewhat less than 1.2 MHz in the 148-149.9 MHz band.^{9/} Those subscriber uplink frequencies are to be shared among three commercial Little LEO systems (ORBCOMM, Final Analysis and Leo One), as well as with VITA. Moreover, all four of those Little LEO systems must share that spectrum with the terrestrial users and be operated in a non-interfering manner.

ORBCOMM is sharing the spectrum with the terrestrial users by carefully monitoring the frequency usage and avoiding transmitting on occupied channels. ORBCOMM has developed and deployed a sophisticated methodology for minimizing any risk of transmitting on active channels, referred to as its Dynamic Channel Activity Assignment System ("DCAAS").^{10/} ORBCOMM has been flying its initial two satellites for over two years now, and the DCAAS methodology has worked exceedingly well. ORBCOMM has received no complaints of interference from any terrestrial users.

As part of those DCAAS operations, ORBCOMM has been monitoring activity in the 148-149.9 MHz band. Based on the information collected, it is not clear whether all of the

9/ Under the Commission's Second Processing Round Order (Amendment of Part 25 of the Commission's Rules to establish Rules and Policies Pertaining to the Second Processing Round of the Non-Voice, Non-Geostationary Mobile Satellite Service, IB Docket No. 96-220, FCC 97-370, released October 15, 1997), the non-spread spectrum systems are excluded from using some 500 MHz of the lower half of the band for their transmissions so as to maximize sharing with the E-SAT spread spectrum system. In addition, portions of the upper half of the band are reserved for gateway transmissions, and thus will not be available for subscriber uplinks. ORBCOMM further observes that the approximately 355 kHz of spectrum in the lower portion of the 148-149.9 MHz band to be shared with the spread spectrum system may not be usable, insofar as the DCAAS-like scanners may show the channels to be "occupied" as a result of the spread spectrum system. As a result of these various constraints, somewhat less than 1.2 MHz of the 1.9 MHz in the 148-149.9 MHz band will be available for non-spread spectrum NVNG MSS subscriber uplinks.

10/ The Notice discusses the ORBCOMM-developed DCAAS methodology for sharing. Notice at n. 31.

Little LEO systems will be able to find a sufficient number of unoccupied channels for reliable, interference-free subscriber uplinks in the less than 1.2 MHz of spectrum available for subscriber uplinks in the 148-149.9 MHz band, taking into account their need to avoid interference to ORBCOMM and the terrestrial users. ORBCOMM has observed that, particularly during peak periods in North America, it appears that there are dramatic drops in the number of available channels, and hence the margin by which the number of unoccupied channels exceeds the number of channels needed for a single system's successful operations.^{11/} ORBCOMM is concerned that with the two additional NVNG satellite systems operating their non-spread spectrum subscriber uplinks in the 148-149.9 MHz band, there may not be a sufficient number of unoccupied channels, after protecting against interference to ORBCOMM and the terrestrial users, to ensure that all of the new systems will be able to function.

The two megahertz of spectrum proposed to be allocated in this proceeding are well-suited to alleviate this potential problem. Although only a regional allocation, these two megahertz of spectrum would provide needed relief in the United States, where the anticipated peak-period shortages are particularly acute. Newly-licensed systems can readily be designed so as to operate their subscriber uplinks in the 455-456 MHz and 459-460 MHz bands, and thereby relieve the possibility of being unable to select open channels if all of the

^{11/} In its comments on the Second Round NPRM, ORBCOMM included a number of graphs representing the typical channel availability over the Eastern United States (as reflected by ORBCOMM's satellite passes over Dulles, Virginia) during different times of day. See ORBCOMM Comments in IB Docket No. 96-220, filed December 20, 1996, at Attachment 1. As those graphs indicate, the number of available channels in the 148-149.9 MHz band ranges from over 500 (during the period of 11:50 am - 12:01 pm EST) to less than 80 (during the period of 12:16 pm - 12:28 pm EST). Moreover, these statistics overstate the number of channels available for subscriber uplinks because ORBCOMM was scanning the entire 148-149.9 MHz band.

Little LEO systems were operating subscriber uplinks solely in the less than 1.2 MHz of spectrum in the 148-149.9 MHz band. In addition, in light of the lack of success by the United States at WRC-97 in obtaining significant additional Little LEO allocations, these two megahertz of spectrum are the only near-term relief available.^{12/}

II. THE LITTLE LEO SYSTEMS CAN SHARE THESE BANDS WITH TERRESTRIAL USERS ON A NON-INTERFERENCE BASIS

The Commission acknowledged the potential for the use of these bands to supplement the subscriber uplink frequencies in the Second Processing Round Order.^{13/} The Commission recognized that any such usage is dependent on a finding that sharing of these bands with the terrestrial users must be feasible, and indicated that such a determination is to be made in this separate allocation proceeding.^{14/} ORBCOMM believes that the Commission can and should make such a finding based on the record developed to date in the WRC preparatory processes (not to mention the expected showings in this allocation proceeding).

^{12/} The upper Transit Band (399.9-400.05 MHz) would not be useful for subscriber uplinks because of the intra-system interference resulting from the lack of separation between the 401 MHz subscriber and gateway downlinks. In addition, one megahertz of adjacent spectrum (454-455 MHz) was allocated at WRC-97 for NVNG services by several countries, including the United States, through a footnote allocation. That spectrum could be use to provide a further measure of protection to the terrestrial users to the extent it is also allocated domestically in the United States, because the Little LEO systems would be able to scan over a wider range of frequencies in search of "gaps." Because the Notice had not specified the 454-455 MHz band, however, such a domestic allocation may require an additional Notice of Proposed Rulemaking.

^{13/} Second Processing Round Order at ¶ 22.

^{14/} Second Processing Round Order at ¶ 23-24.

ORBCOMM's own experience with sharing spectrum with terrestrial users indicates that such sharing might also take place in the 455-456 MHz and 459-460 MHz bands. Recognizing the absence of "clear" spectrum below 1 GHz (but the need to operate there to minimize costs), ORBCOMM designed its system to be able to share spectrum without displacing the incumbent users. ORBCOMM thus developed DCAAS as part of its original system design submitted in February 1990, and has refined that sharing methodology as it gained new information and additional experience over time. ORBCOMM has successfully used that sharing methodology for the past two years while its initial two satellites have been in operation.

The DCAAS sharing approach uses sensitive scanning receivers to monitor the usage in the band, and in addition utilizes sophisticated algorithms to predict, based on current scans and previously gathered data, whether a channel will be occupied. The satellite then transmits to the subscriber units a list of the "best" channels to transmit on (that is, the channels that will not be occupied), and the subscriber units transmit on one of those channels. That list of channels is updated approximately every four to six seconds as new information on usage is gathered. In this manner, ORBCOMM is able to avoid subscriber transmissions on channels occupied by terrestrial transmitters.

ORBCOMM's system also incorporates other safeguards to minimize the risk of any harmful interference to the terrestrial users. First, ORBCOMM uses a channelization scheme based on 2.5 kHz increments, and thus exploits channels that are interstitial to the terrestrial channels. This minimizes the risk that even if the DCAAS system inaccurately predicts a vacant channel, any Little LEO subscriber unit transmission will be "right on top of" an occupied terrestrial channel.

Second, the Little LEO subscriber uplinks are presently subject to Footnote US323, which imposes strict limits on duty cycles and transmission lengths.^{15/} Presumably similar limitations would be incorporated onto Little LEO operations in the 455-456 MHz and 459-460 MHz bands, particularly because the international allocation includes a mandate that the Little LEO services not constrain the terrestrial operations.^{16/} These operational constraints on the subscriber transmissions thus are available to minimize any interference that could possibly be suffered by the terrestrial users. Finally, the relatively low-power and wide geographic dispersion of the Little LEO subscriber units further reduces any risk of potential interference.

These protections have been successfully utilized to avoid harmful interference to the terrestrial operations in the 148-149.9 MHz band. ORBCOMM believes that these same techniques could operate in the 455-456 MHz and 459-460 MHz bands as well. There is nothing unique about propagation characteristics in the 450 MHz band that would make the DCAAS scanning any less effective. Indeed, to the extent some of the terrestrial channels are used by auxiliary broadcast transmitters,^{17/} those transmissions are likely to be of such a long duration (relative to mobile terrestrial operations) that the DCAAS scanners will most certainly identify those channels as occupied.

^{15/} Individual transmissions are limited to 450 ms in length and consecutive transmissions on the same frequency from the same transmitter must be separated by at least 15 seconds. In addition, the duty cycle is limited to 1 % in any fifteen minute period.

^{16/} See Notice at ¶ 4.

^{17/} Notice at ¶ 12.

Motorola has claimed that the 455-456 MHz and 459-460 Mhz bands are more heavily used than the 148-149.9 MHz band.^{18/} To the extent that there is any difference in usage, such a difference could conceivably affect the number of available channels. Any differences in traffic usage would not, however, impact the ability of the DCAAS methodology to detect (and preclude Little LEO subscriber transmissions on) occupied channels, nor does it alter the very brief, low-power nature of the Little LEO subscriber transmissions. ORBCOMM therefore does not believe that any such difference in terrestrial usage would create any greater risk of harmful interference to the terrestrial users from the Little LEO subscribers.

Under the international allocation, the Little LEO systems are obligated to avoid harmful interference to the terrestrial users. Thus, to the extent that there is significantly greater usage by the terrestrial users in these bands as opposed to the 148-149.9 MHz band, the Little LEO systems bear the risk that a sufficient number of unoccupied subscriber uplink channels will be available. The terrestrial users, in contrast, bear no risk because the Little LEO operators are required by the international allocation to avoid harmful interference, and not to constrain the terrestrial operations.

ORBCOMM believes that such a small risk is worth assuming by the Little LEO satellite systems, however, particularly because those systems do not require large gaps in the usage in order to "squeeze in" their very short transmissions. Moreover, for many Little LEO applications, such as remote meter reading, those automated transmissions can be scheduled for the middle of the night, when both terrestrial mobile and broadcast auxiliary transmissions can be expected to be relatively sparse. Thus, the 455-456 MHz and 459-460 MHz bands are likely to have significant utility to the Little LEO systems. ORBCOMM thus

^{18/} See Notice at ¶ 15.

continues to support the domestic allocation of those frequencies, notwithstanding the unsupported fears of Motorola.

Finally, ORBCOMM notes the continuing concern of the petroleum interests because of one 25 kHz channel at 459.000 MHz that is assigned for primary use for oil spill containment. Apparently the petroleum interests are worried that this critical use could be compromised if the Little LEO satellite systems access this channel on a secondary basis. ORBCOMM does not believe that their concerns are well-founded. ORBCOMM observes that there are a half-dozen other channels outside the 455-456 MHz and 459-460 MHz bands that are also dedicated to oil spill containment on a primary basis.^{19/} Thus, the channel at 459.000 MHz is not the only oil spill containment channel. In addition, ORBCOMM observes that this channel is not dedicated exclusively to oil spill containment activities, but is available already for use on a secondary basis by other users in the Petroleum Radio Service.^{20/} Such secondary use is required to cease upon notification that the channel is being used for oil spill activities. To the extent that this channel is being used for oil spill containment activities (or any other terrestrial use), then a DCAAS-like system will automatically avoid subscriber transmissions on those channels, without even requiring a notification as is the case with the current secondary operations in those bands.^{21/}

^{19/} 47 C.F.R. § 90.65(b).

^{20/} 47 C.F.R. § 90.65(c)(6).

^{21/} ORBCOMM also assumes that Little LEO subscribers are unlikely to be located near the remote areas where most oil spills occur, further reducing any risk of harmful interference.

ORBCOMM thus believes that the Little LEO systems would not pose a risk to oil spill containment operations, even if this channel was available to the Little LEO systems. Indeed, ORBCOMM believes that its geographically ubiquitous services would be of great use to the oil industry for monitoring oil pipelines and ships, as well as supporting clean up activities if a spill should occur. Nevertheless, ORBCOMM observes that if the Commission were to decide that this particular channel should not be subject to use by the Little LEO systems, the satellite systems should readily be programmable to always avoid assignment of Little LEO subscriber transmissions on that channel.^{22/} Thus, the Commission can carve out "exceptions" to the allocation of these bands to the Little LEO satellite service if deemed necessary.

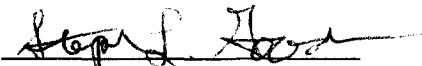
III. CONCLUSION

ORBCOMM urges the Commission to adopt the proposed domestic allocation of the 455-456 MHz and 459-460 MHz bands to the Little LEO satellite service for subscriber uplinks. Such an allocation will allow the satellite system operators to make their highly beneficial services available to the public. At the same time, the record (including ORBCOMM's actual operations for over two years) confirms that the Little LEO satellite

^{22/} Indeed, the Commission's sharing plan for the 148-149 MHz band would incorporate a similar feature insofar as the non-spread spectrum systems would have to avoid subscriber transmissions in the middle portion of the band to minimize harmful interference to E-SAT's contemplated spread spectrum use of those frequencies.

systems will be able to share the spectrum with the terrestrial users without causing harmful interference.

Respectfully submitted,

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